DESIGN PROCEDURE FOR GRADIENT TERRACES

Steps

1. Determine land slope from field surveys.

2. Determine soil type and erosion from soil survey and/or field check.

3. Determine T/K values from Technical Guide Section I-C, Erosion Prediction.

4. Determine rainfall factor (R) for location from Technical Guide Section I-C, Erosion Prediction

5. Determine erosion index (EI) for location from Technical Guide Section I-C, Erosion Prodiction.

6. Determine most intensive use expected for the land in planning with the landowner or operator and expected type of management.

7. Determine design "C" value from Technical Guide Section I-C, Erosion Prediction.

8. Determine slope length using the Water Erosion Calculator.

   (a) Align the "R" value with "C" value.
   (b) Align arrow on upper slide with T/K values.
   (c) Using the percent slope from Step 1 in the contour line place hairline over slope, read the slope length, "L" upper the hairline for the appropriate slope range.

   Alternate method for determining slope length using the pocket calculator. Use Formula:

   Annual Soil Loss T_____ = LS _____ x R _____ x K _____ x P_____ xC _

   (a) Fill in values T, R, K, and C from previous steps.
   (b) Find P value from Technical Guide Section I-C, Erosion Prediction, page I-C-1.
   (c) Divide T value by R, K, P and C which gives LS value.
   (d) From LS chart, Technical Guide Section I-C, Erosion Prediction, Page I-C-1 with percent slope and C value interpolate for slope length value at top of chart.

9. Determine the horizontal terrace spacing by adding the front slope length (L2) to the slope length. This horizontal spacing may be increased as much as 10 percent to provide better alignment and location, to miss obstacles in the field, to adjust for farm machinery, or to reach a satisfactory outlet.

10. Determine terrace length from field surveys and/or aerial photos.

11. Determine terrace drainage area from field survey and spacing.

12. Determine peak discharge for each terrace channel. Use either 4 c.f.s. per acre or interpolate from the charts in Exhibit 2-10, Chapter 2 to figure Qp.

13. Determine terrace channel grades from field surveys and/or profile drawings.

14. Determine channel depths using allowable velocity for the soil from Technical Guide Specification 600 and Exhibit IN 8-7 (3 sheets). If not able to meet the allowable velocity on the appropriate exhibit, then one must use vegetation, go to graph with flatter side sloper, or layout the terrace channel on a flatter grade.

15. Fill in velocity provided column and Q provided column, velocity provided should be less than allowable velocity for the soil. Q provided will be the Q at the top of the ridge height for the design slope on the terrace design graph used.

16. Check all your work for omissions and errors.

Example Design - Gradient Terrace

Steps

1. Land slope: 4%; Terrace system located in Putnam County.

2. Russell silt loam, 3 erosion

3. T = 4 tons per acre per year, T/K = 11 - K = .37

4. R = 180

5. EI = 16

6. Continuous row crop - conservation tillage with till plant and 2000 pound to 3000 pound of crop residue on surface after planting.

7. C = 0.238

8. Slope length = 180 ft

9. Terrace spacing = 180 + 30 ft = 210 ft (30 ft. front slope)

10. Terrace lengths - Terrace 1 - 800 ft.
Terrace 2 - 900 ft.
Terrace 3 - 800 ft.

11. Terrace No. 1 - DA = <u>5 ac.</u> from observation in field and aerial photos.
    Terrace No. 2 - DA = 900 ft. x 210 ft. ÷ 43,560 sq. ft./ac. = <u>4.3 Ac.</u>
    Terrace No. 2 - DA = 800 ft. x 210 ft. ÷ 43,560 sq. ft./ac. = <u>3.9 Ac.</u>

12. From page 2.65, Exhibit 2-10, Chapter 2 for a 5 acre drainage area, moderate slopes, curve number - 75 and 10-year - 24 hour rainfall of 4.3 inches, the Qp = 12 c.f.s.; therefore, the rate of discharge per acre is approximately 12 c.f.s. ÷ 5 ac. = 2.4 c.f.s./ac.
    Terrace No. 1 - Qp = 5 ac. x 2.4 c.f.s./ac = <u>12 c.f.s.</u>
    Terrace No. 2 - Qp = 4.3 ac. x 2.4 c.f.s./ac. = <u>10.3 c.f.s.</u>
    Terrace No. 3 - Qp = 3.9 ac. x 2.4 c.f.s./ac. = <u>9.4 c.f.s.</u>

13. Terrace No. 1 - <u>Grade = 0.6%</u>
    Terrace No. 2 - <u>Grade = 0.7%</u>
    Terrace No. 3 - <u>Grade = 0.7%</u>

14. Allowable velocity = 2.0 ft./sec. for Russell Silt loam. Channel side slopes approximately 15 to 1 (equipment width 15 feet - ridge height will be around 1 ft.). From Exhibit IN 8-7, sheet 2 for 15 to 1 bare channel graph.
    Terrace No. 1 - Depth = 0.8 ft. + 10% settlement = <u>0.9 ft.</u>
    Terrace No. 2 - Depth = 0.7 ft. + 10% settlement = <u>0.8 ft.</u>
    Terrace No. 3 - Depth = 0.7 ft. + 10% settlement = <u>0.8 ft.</u>

    Note: Had terrace No. 1 had a slope of 0.8% grade, the alternatives would be to (1) vegetate channel, (2) use 30:1 side slope graph, or (3) realign the terrace system for less grade.

15. Terrace 1 - Velocity $\leq$ 2.0 ft./sec - Q1 = 13.2 c.f.s.
    Terrace 2 - Velocity $\leq$ 2.0 ft./sec. - Q2 = 10.4 c.f.s.
    Terrace 3 - Velocity $\leq$ 2.0 ft./sec. - Q3 = 10.4 c.f.s.

16. Check all your work for omissions and errors.

DESIGN

Land slope 4 % Soil type and erosion Russell sil - 3 erosion

T/K value 11 Rainfall factor 180 Erosion index 16

Most intensive land use expected and type of management: conservation tillage with till plant and 2000 to 3000 lbs. vegetative or surface after planting.

Design "C" value 0.238 Design slope length(L) 180 feet

L_1= 15 feet Terrace spacing $(L+L_2)$= 195 feet

L_2= 15 feet Terrace spacing used 1/= 210 feet

L_3= 15 feet Adequacy of outlet: Established waterway and good vegetation - has adequate capacity.

(to fit equipment)

Rainfall (10 yr.) 4.3 inches 2/ CN 75 Slope Factor - (circle one) Flat Mod. Steep

Terrace number	Length ft.	Drainage 2/ area acres	Qp 2/ c.f.s.	Channel grade %	Depth ft.	Channel 2/ s.s.	Area 2/ Sq.ft. Min.	Velocity 2/ (design) f.p.s.	Velocity 2/ (provided) f.p.s.	Q 2/ (provided) c.f.s.
1	800	5	12.0	0.6	0.9	15:1	8	2.0	1.8	13.2
2	900	4.3	10.3	0.7	0.8	15:1	8	2.0	1.8	10.4
3	800	3.9	9.4	0.7	0.8	15:1	8	2.0	1.8	10.4

1/ Horizontal spacing may be increased not more than 10 percent to provide better alignment and location, to miss obstacles in the field, to adjust for farm machinery, or to reach a satisfactory outlet.

2/ Show only if grade exceeds 0.6%.

CONSTRUCTION CHECK (SEE BACK)

Terrace number	Constructed length ft.	Average total depth ft.
1	810	1.2
2	920	0.9
3	795	1.0

I certify that this job meets all the requirements of Indiana Standards and Specifications for Terrace (Code 600) and the plans as designed.

Checked by: Al Checker, SCT

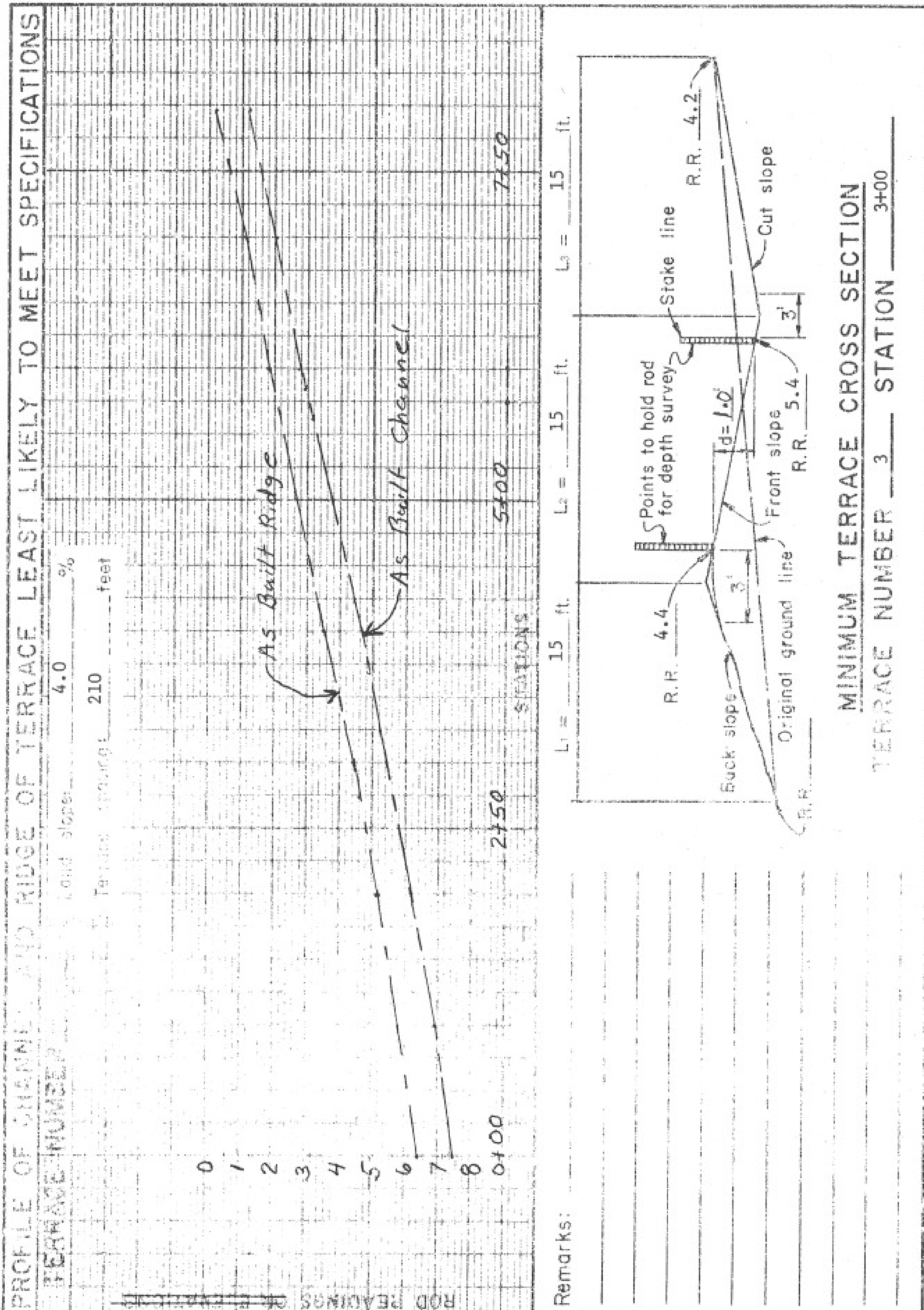
Date: July 27, 1981

TERRACES WITH GRASSED WATERWAY OR VEGETATED AREA OUTLET

NAME John Jones

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed I. M. Okay	Date 6/81	Approved by U.R. Right, D.C.
" " "		Title June 6, 1981
Drawn		Title
Checked U. R. Right	6/81	Sheet No. 1 of 1 — Drawing No.
Reviewed " "		



IN-ENG-16 2(2) Rev. 6-81

DESIGN PROCEDURE FOR PARALLEL TERRACES WITH UNDERGROUND OUTLET

Steps

Horizontal Terrace Spacing

1. Determine land slope from field surveys.

2. Determine soil type and erosion from soil surveys, and/or field check.

3. Determine T/K values from Technical Guide Section I-C, Erosion Prediction.

4. Determine rainfall factor (R) for location from Technical Guide Section I-C, Erosion Prediction.

5. Determine erosion index (EI) for location from Technical Guide Section I-C, Erosion Prediction.

6. Determine most intensive use expected for the land in planning with the landowner or operator and expected type of management.

7. Determine design "C" value from Technical Guide Section I-C, Erosion Prediction.

8. Determine slope length using the Water Erosion Calculator:

   (a) align the "R" value with "C" value;

   (b) align arrow on upper slide with T/K value;

   (c) using the percent slope from step 1 in the contour line, place h line over slope, read the slope length "L" under the hairline fo the appropriate slope range.

   Alternate method for determining slope length using the pocket calculator. Use formula:

   Annual Soil Loss T___ = LS___ x R___ x H___ x P___ x C___

   (a) Fill in value, T, R, K and C from previous steps.

   (b) Find P value from Technical Guide Section I-C, Erosion Predicti page I-C-1.

   (c) Divide T value by R, K, P and C which gives LS value.

   (d) From LS chart, Technical Guide Section I-C, Erosion Prediction page I-C-1, with percent slope and C value interpolate for slo length value at top of chart.

9. Determine the horizontal terrace spacing by adding the front slope length (L_2) to the slope length. This horizontal spacing may be increased as much as 10% to provide better alignment and location, to miss obstacles in the field, to adjust for farm machinery or to reach a satisfactory outlet.

Required Runoff Storage

10. Determine 10 yr.-24 hr. rainfall in inches from EFM Chapter 2, Ex. IN-2-4.

11. Determine CN from EFM Chapter 2 based on the soils and the cropping and management proposed. Use IN-ENG-10 as needed.

12. Determine runoff in inches from EFM Chapter 2, Ex. 2-7A.

13. Determine acceptable drawdown time in hours for terraces based on crops and landowners desires. Normally, 12 to 24 hours is acceptable. The smaller the drawdown time in hours the larger the underground outlet.

14. Determine terrace or ridge length from field survey of actual staked line.

15. Determine terrace DA by multiplying the terrace spacing by terrace length and divide by 43,560 sq. ft./ac. DA of top terrace may have to be determined in field if not on a terrace spacing.

16. Determine runoff storage in cu. ft. by multiplying the drainage area in acres by the runoff in inches by 3,630.

Sediment Storage

Note: Provide 10-yr. sediment storage unless provisions are made for periodically cleaning it. Because of the shape of terraces, plowing may not be a practical method of maintenance.

17. Using the T value from step 3, or use the USLE, determine soil loss in tons/ac.

18. Total Tons - multiply tons/ac. by acres for drainage area.

19. Convert tons to cu. ft. for a 10-year design life. Multiply tons by 22 cu. ft. per ton (equivalent to soil of 90 lbs. per cu. ft.).

Total Storage Required

20. Add the sediment storage to the runoff storage.

Available Terrace Storage

21. Calculate available terrace storage at the selected fill height by using Ex. 8-2, 8-3, IN 8-3 or 8-12, Terrace Storage.

22. Recalculated available terrace storage at different terrace elevations if storage from step 22 is not close to required storage from step 21.

Orifice Design

Note: Terraces in series require an orifice if underground outlet is not designed for pressure flow or other controls are not in the system. Single terraces may also require an orifice to protect the underground outlet from pressure flow.

23. Determine required c.f.s. Required c.f.s. = total storage in cu. ft. divided by the number of seconds in drawdown period (86,400 for 24 hrs.).

Note: Runoff storage only could be used to calculate required discharge. Using the total storage will add a small factor of safety and make the drawdown time at full ridge height more accurate.

24. From profile determine elevation of ridge and channel.

25. Determine d_1 and $0.7d_1$ (d_1 is elevation ridge - elevation channel).

26. Determine minimum value of $H = 0.7d_1 + d_2$ (1.0 is the minimum value of d_2).

27. Determine orifice size. Using required c.f.s. and H (min.) enter EFM p 8-102.

Note: If d_2 is to be held at 1.0', select an orifice size that yields an actual discharge in excess of the required discharge at the H (min.). Proceed to step 30. If you wish to make the actual discharge equal the required discharge proceed to step 28.

28. Interpolate values of H to get actual orifice discharge = required c.f.s.

29. Using new value of H, adjust d_2.

30. Using d_2 find orifice elevation. Channel elev - d_2 (d_2 = 1.0 for minimum). Check underground outlet profile to be sure that orifice elevation will not conflict with drain elevation.

Underground Outlet Design

31. Determine required c.f.s. Required c.f.s. is the sum of the orifice discharges to the section in question.

32. Using drain grade on the profile and the required c.f.s., enter EFM Ch. 8, Ex. IN-8-6, after pg. 8-102 to determine drain size and capacity for plastic tubing or Ch. 14, Ex. IN-14-11, pg. 14-109 for clay or concrete tile.

33. Terrace section design above the level ridge, use sheet IN-ENG-16 and design procedures for gradient terraces, pg. 8-123.

34. Fill out the sheets in your plan.

35. Check all your work for omissions and errors.

Example Design - Parallel Terraces With Underground Outlet

Steps

Horizontal Terrace Spacing

1. Land Slope: 5%, terrace System located in Sullivan County

2. Alford Silt loam, 3 erosion

3. T = 4 tons per acre per year, T/K = 11, K = 0.37

4. R = 200

5. EI = 16

6. Crop sequence - Cont. corn residue removed, cover crop residue left, conservation tillage-till plant 1000-2000 lbs. residue

7. C = 0.224

8. Slope length = 85 ft.

9. Terrace spacing = 85 ft. + 15 ft. = 100 ft. Use 105 ft. to fit farm machinery.

Required Runoff Storage

10. Rainfall = 4.5 in.

11. CN = 75

12. Runoff = 2.06 in.

13. Drawdown time = 24 hrs.

14. Terrace lengths - #1 = 750 ft.
#2 = 850 ft.
#3 = 900 ft.

15. Terrace DA - $\#1 = \frac{105 \text{ ft.} \times 750 \text{ ft.}}{43{,}560 \text{ ft.}^2/\text{ac.}} = 1.8 \text{ ac.}$

$\#2 = \frac{105 \text{ ft.} \times 850 \text{ ft.}}{43{,}560 \text{ ft.}^2/\text{ac.}} = 2.1 \text{ ac.}$

$\#3 = \frac{105 \text{ ft.} \times 900 \text{ ft.}}{43{,}560 \text{ ft.}^2/\text{ac.}} = 2.2 \text{ ac.}$

quired Runoff Storage - #1 = 2.06 in. x 1.8 ac. x 3630 = $\underline{13,460\ ft.^3}$

#2 = 2.06 in. x 2.1 ac. x 3630 = $\underline{15,703\ ft.^3}$

#3 = 2.06 in. x 2.2 ac. x 3630 = $\underline{16,451\ ft.^3}$

= 4 ton/ac./year

:otal tons - #1 = 4 ton/ac./yr. x 1.8 ac. = 7.2 ton/yr.
#2 = 4 ton/ac./yr. x 2.1 ac. = 8.4 ton/yr.
#3 = 4 ton/ac./yr. x 2.2 ac. = 8.8 ton/yr.

Sediment in cu. ft. for 10 years design life.

#1 = 7.2 ton/yr. x 22 $ft.^3$/ton x 10 yr. = $\underline{1584\ ft.^3}$
#2 = 8.4 ton/yr. x 22 $ft.^3$/ton x 10 yr. = $\underline{1848\ ft.^3}$
#3 = 8.8 ton/yr. x 22 $ft.^3$/ton x 10 yr. = $\underline{1936\ ft.^3}$

ıl Storage Required

Total Storage

#1 = 13,460 $ft.^3$ + 1584 $ft.^3$ = $\underline{15,044\ ft.^3}$
#2 = 15,703 $ft.^3$ + 1848 $ft.^3$ = $\underline{17,551\ ft.^3}$
#3 = 16,451 $ft.^3$ + 1936 $ft.^3$ = $\underline{18,387\ ft.^3}$

ailable Terrace Storage

.. Calculated Storage - #1 = 13000 $ft.^3$ - Too small
#2 = 13862 $ft.^3$ - Too small
#3 = 17137 $ft.^3$ - Too small

2. Calculations:

Terrace No.	Ridge Elevation	Storage $Ft.^3$
1	94.8	15060 OK
2	90.0	17563 OK
3	85.8	19730 Too lar Use 85.7 ridg elev

Orifice Design

23. Required c.f.s. for 24 drawdown period:

Terrace - #1 15044 $ft.^3 \div$ 86400 sec/day = $\underline{0.17}$ c.f.s.
#2 17551 $ft.^3 \div$ 86400 sec/day = $\underline{0.20}$ c.f.s.
#3 18387 $ft.^3 \div$ 86400 sec/day = $\underline{0.21}$ c.f.s.

24.

Terrace No.	Ridge Elev.	Channel Elev.	Drain Elev.
1	94.8	92.0	89.6
2	90.0	87.8	84.8
3	85.7	83.0	80.4

Note- Add appropritate settlement to these ridge elevations.

25, 26, 27, 28 & 29.

Terrace No.	d_1 ft.	0.7d ft.	d_2 ft.	H ft.	Required c.f.s.	Orifice Size Inches	Discharge Provides c.f.s.
1	2.8	2.0	1.0	3.0	0.17	2.00	0.182
2	2.2	1.5	1.0	2.5	0.20	2.25	0.210
3	2.7	1.9	1.0	2.9	0.21	2.25	0.227

30. Orifice Elevations

Terrace #1 = 91.0
Terrace #2 = 86.8
Terrace #3 = 82.0

Underground Outlet Design

31. Accumulated c.f.s. at each inlet from Step 28:

Terrace #1 = 0.182 c.f.s.
#2 = 0.182 + 0.210 = 0.392 c.f.s.
#3 = 0.182 + 0.210 + 0.227 = 0.619 c.f.s.

32. Drain grade = 4.4%
From plastic tubing chart:

Below ridge #1 = 4 inches - 0.35 c.f.s.
Below ridge #2 = 5 inches - 0.61 c.f.s.
Below ridge #3 = 5 inches - 0.61 c.f.s.

33. Check of channel stability above level section. All terrace channel slopes are 0.006 ft./ft. except the right channel on terrace #1. For the short section above the level ridge on terrace #1 use a minimum of 0.9 foot ridge.

Length = 9 + 00 - 4 + 00 = 500 ft.

$$\text{Drainage area} = \frac{500 \text{ ft} \times 105 \text{ ft}}{43{,}560 \text{ ft}^2/\text{ac.}} = 1.2 \text{ ac.}$$

Qp = 1.2 ac. x 4 c.f.s./ac. = 4.8 c.f.s.
Channel grade = 0.013 ft./ft.
Maximum allowable velocity for average soil = 2.0 ft./sec.
Use Exhibit IN-8-7 and the above data. Since terrace ridge heights are usually around 1 foot and equipment width is 15 feet, start with the 15 to 1 sheet. A ridge height or channel depth of 0.8 ft. (min.) will work. Actual velocity is less than 2.0 ft./sec. Had the velocity been above 2.0 ft./sec., then the channel would have to be designed as a vegetated channel or the side slope increased to 30 to 1.

34. Fill out the sheets of your plan.

35. Check all your work for omissions and errors.

DESIGN DATA

Land slope 5 %   Soil type and erosion Alford Silt Loam, 3

T/K value 11   Rainfall factor 200   Erosion index 16

Most intensive land use expected and type of management: Cont. corn, RdR, Cover crop RdL, Min. tillage - Till plant 1000 to 2000 lbs residue

Design "C" value 0.224 Design slope length (L) = 85 feet L_1 = 15 feet

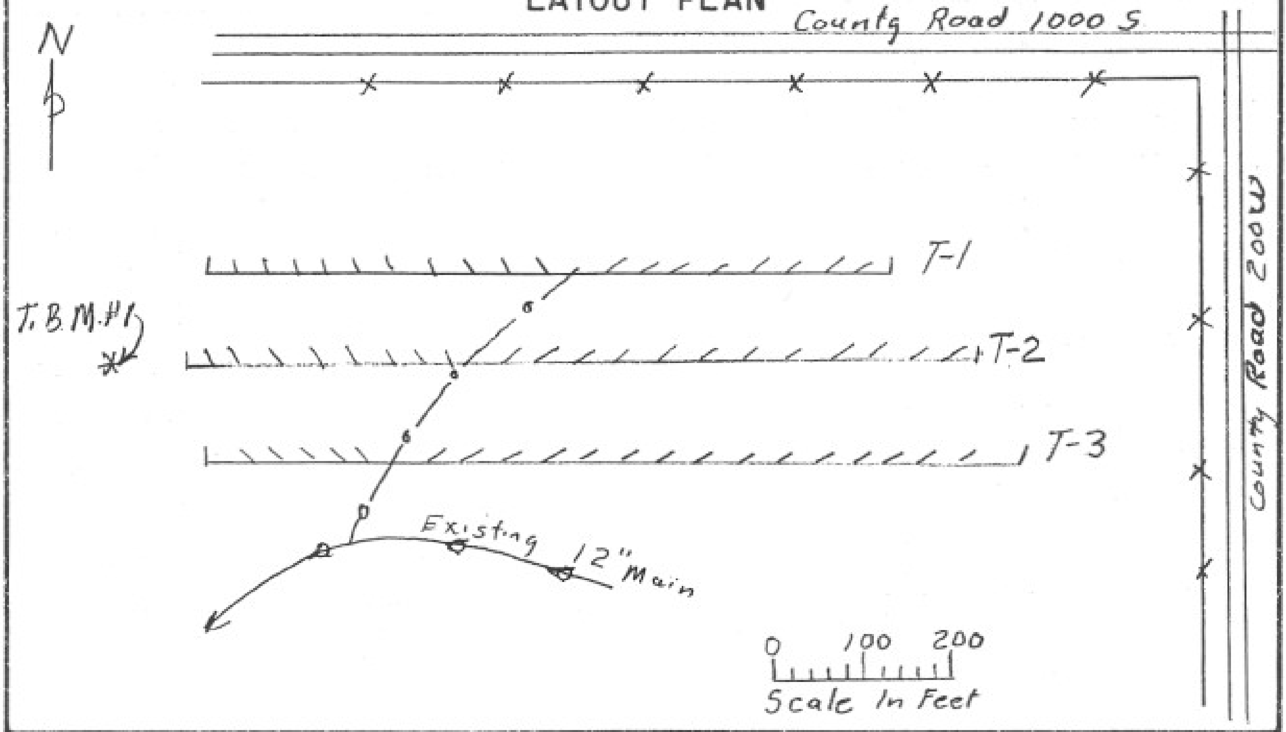
Ridge spacing ($L + L_1$) = 100 feet   Ridge spacing used 1/ = 105 feet

10-Year Rainfall 4.5 inches   Curve Number 75   Runoff 2.06 inches

Planned Draw-down Time 24 hours

1/ Horizontal spacing may be increased as much as 10 percent to provide better alignment and location to miss obstacles in the field, to adjust for farm machinery, or to reach a satisfactory outlet. An additional 10 percent may be added where underground outlets are used.

LAYOUT PLAN



Benchmark Description and Elevation: T.B.M. #1 Spike on south side of lone white oak, 75 ft. west of terrace #1. Elevation 100.00 assumed.

ESTIMATED QUANTITIES

Item	Unit	Quantities
Terraces	feet	2500
Tile - 4-inch	Feet	210
Tile - 5-inch	Feet	100
Riser	Each	3
Outlet pipe	Feet	10
Animal guard	Each	1

TERRACES OR WATER AND SEDIMENT CONTROL BASINES WITH UNDERGROUND OUTLETS

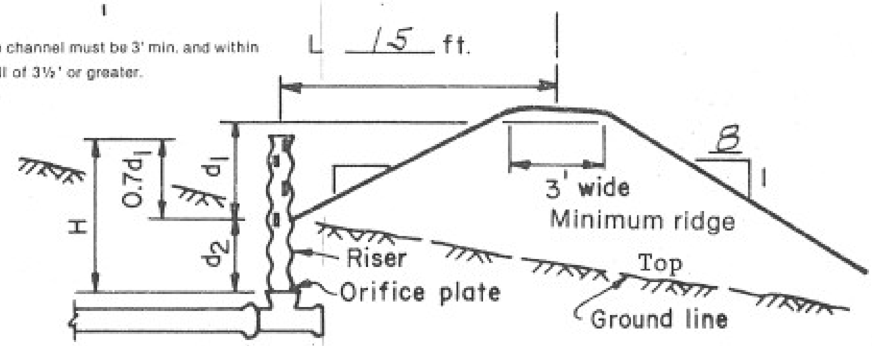
NAME Tom Sullivan

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed	I.M. Okay	2-81	Approved by May B Aung
Drawn	" " "		Title SCT, 2-12-81
Checked	U.R. Right	2-81	Title
Reviewed	" " "		Sheet No. Of. / Drawing No.

(EFM Notice IN38, August 1981)

Note: Riser hieght above channel must be 3' min. and within 6" of top of any fill of 3½' or greater.



DESIGN HEAD FOR ORIFICE PLATE

REQUIRED STORAGE						ORIFICE DESIGN							
Ridge No.	D.A. Acres	Accum. D.A. Acres	Required Storage: Runoff Cu.Ft.	Required Storage: Sed. Cu.Ft.	Required Storage: Total Cu.Ft.	Ridge Length	Ridge Elev.	Channel Elev.	d_1 Ft.	$0.7d_1$ Ft.	Orifice Elev.	d_2 Ft.	H Ft.
1	1.8	1.8	13,460	1,584	15044	750	94.8	92.0	2.8	2.0	91.0	1.0	3.0
2	2.1	3.9	15,703	1,348	17551	850	90.0	87.8	2.2	1.5	86.8	1.0	2.5
3	2.2	6.1	16,451	1,936	18387	800	85.7	83.0	2.7	1.9	82.0	1.0	2.9

ORIFICE DESIGN AND SUBSURFACE DRAIN

Ridge No.	Required Capacity CFS	Orifice Size Inches	Discharge Privided CFS	Accum. Discharge CFS	Drain Grade %	Drain Size Inches	Max. Drain Cap. CFS	Draw-down Hours	Channel Above Level Ridge: Depth Ft.	Channel Above Level Ridge: Channel Grade %	Channel Above Level Ridge: Vel. 1/ FPS
1	0.17	2.0	0.182	0.182	4.4	4	0.35	24	0.8	13	2.0
2	0.20	2.25	0.210	0.392	4.4	5	0.61	24			
3	0.21	2.25	0.227	0.619	4.4	5	0.61	24			

1/ SHOW VELOCITY ONLY IF GRADE EXCEEDS 0.6%

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(EFM Notice IN38, August 1981)

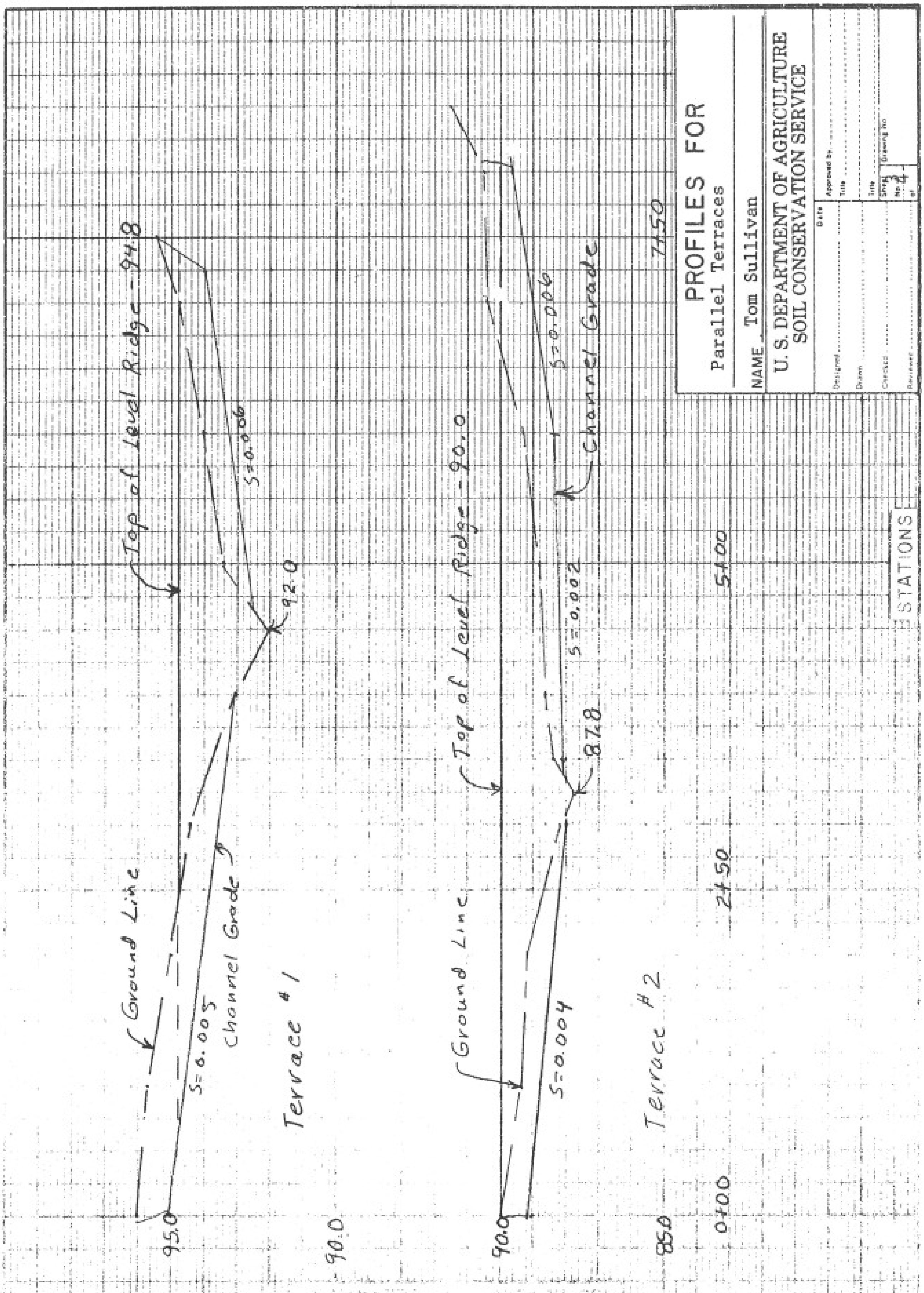
AVAILABLE STORAGE COMPUTATION

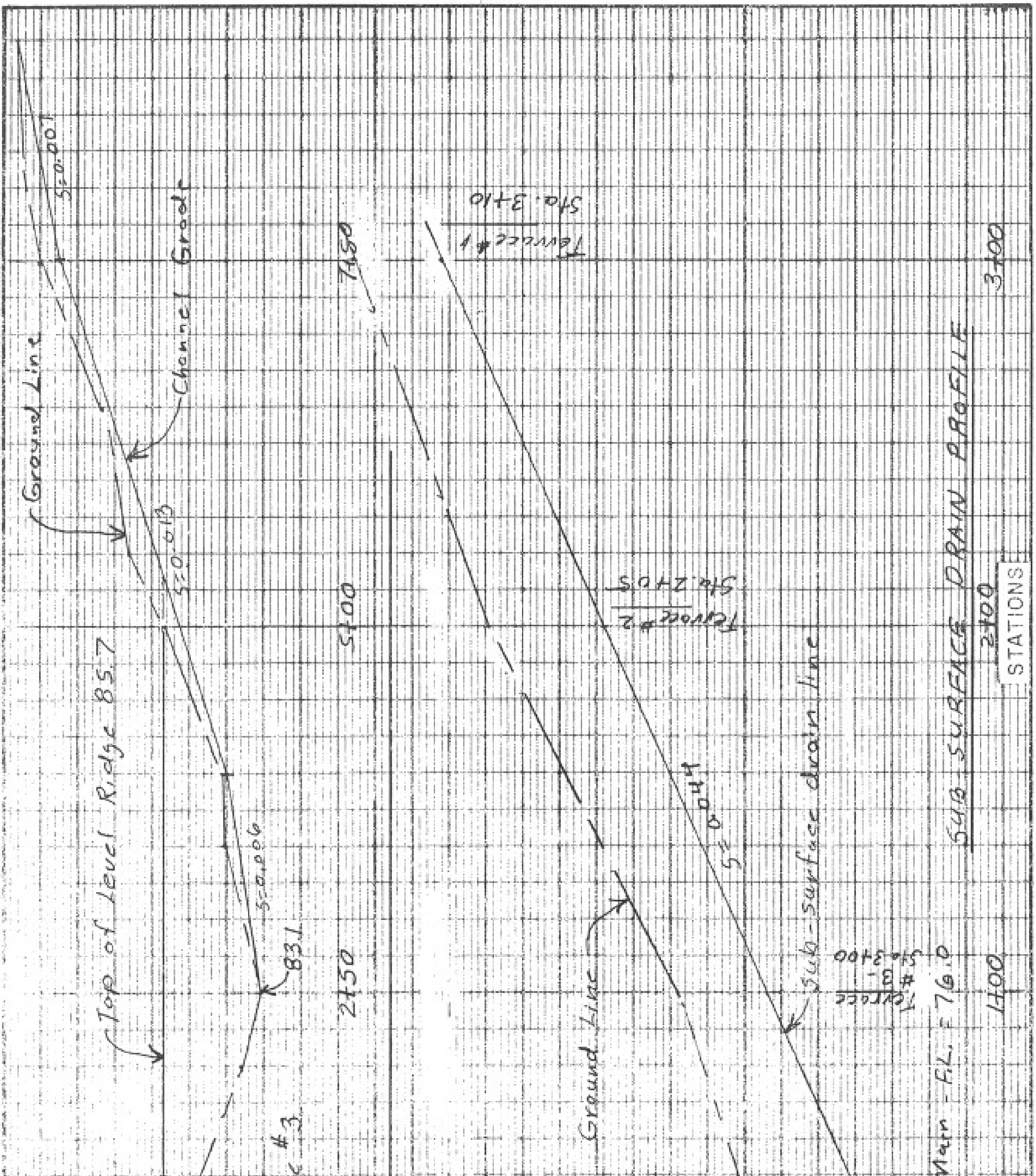
Ridge number	Field slope %	Ridge elevation	Station	Design depth ft.	Cut depth ft.	Storage cu. ft./ft.	Average storage cu. ft./ft.	Dist. ft.	Storage cu. ft.
1	5	94.6	1+00	0	0	0			
			2+00	0.6	0.6	5	2.5	100	250
			3+00	1.1	0.9	11	8.0	100	800
			4+00	1.6	0	37	24.0	100	2400
			4+50	2.6	0	86	61.5	50	3075
			5+00	1.9	0.5	34	60.0	50	3000
			6+00	1.3	0.8	14	24.0	100	2400
			7+00	0.7	0.7	6	10.0	100	1000
			7+25	0	0	0	3.0	25	75
							Too Small →		13000
1	5	94.7	0+75	0	0	0			
			1+00	0.2	0.2	2	1.0	25	25
			2+00	0.7	0.7	6	4.0	100	400
			3+00	1.2	0.9	13	9.5	100	950
			4+00	1.7	0	41	27.0	100	2700
			4+50	2.7	0	92	66.5	50	3325
			5+00	2.0	0.5	37	64.5	50	3225
			6+00	1.4	0.8	16	26.5	100	2650
			7+00	0.8	0.7	8	12.0	100	1200
Use		94.8	7+40	0	0	0	4.0	40	160
							Too Small →		14635
2	5	89.8	0+00	0	0	0			
			1+00	1.0	0.6	10	5.0	100	500
			2+00	1.4	0.8	16	13.0	100	1300
			3+00	1.8	0.2	38	27.0	100	2700
			3+25	2.0	0	54	46.0	25	1150
			3+50	1.7	0.2	35	44.5	25	1112
			4+00	1.6	0.2	31	33.0	50	1650
			5+00	1.4	0.4	20	25.5	100	2550
			6+00	1.2	0.7	13	16.5	100	1650
			7+00	0.7	0.7	6	9.5	100	950
			8+00	0	0	0	3.0	100	300
							Too Small →		13862

AVAILABLE STORAGE COMPUTATION

Ridge number	Field slope %	Ridge elevation	Station	Design depth ft.	Cut depth ft.	Storage cu. ft./ft.	Average storage cu. ft./ft.	Dist. ft.	Storage cu. ft.
2	5	90.0	0+00	0	0	0			
			1+00	1.2	0.6	14	7.0	100	700
			2+00	1.6	0.8	20	17.0	100	1700
			3+00	2.0	0.2	47	33.5	100	3350
			3+25	2.2	0.0	64	55.5	25	1388
			3+50	1.9	0.2	42	53.0	25	1325
			4+00	1.8	0.2	38	40.0	50	2000
			5+00	1.6	0.4	26	32.0	100	3200
			6+00	1.4	0.7	17	21.5	100	2150
			7+00	0.9	0.9	9	13.0	100	1300
			8+00	0	0	00	4.5	100	450
							Okay →		17563
3	5	85.7	0+50	0	0	0			
			1+00	0.6	0	8	4.0	50	200
			2+00	2.0	0	54	31.0	100	3100
			2+50	2.6	0	86	70.0	50	3500
			3+25	2.0	0.2	47	77.5	75	5812
			3+50	1.9	0.3	39	43.0	25	1075
			4+00	1.6	0.0	37	38.0	50	1900
			4+50	0.9	0.2	11	24.0	50	1200
			5+00	0.3	0.4	2	6.5	50	325
			5+25	0	0	0	1.0	25	25
									17137
3	5	85.8	0+25	0	0	0			
			0+50	0.2	0	2	1.0	25	25
			1+00	0.8	0	12	7.0	50	350
			2+00	2.2	0	64	38.0	100	3800
			2+50	2.6	0	98	81.0	50	4050
			3+25	2.2	0.2	56	77.0	75	5775
			3+50	2.1	0.3	48	52.0	25	1300
			4+00	1.8	0.0	45	46.5	50	2325
			4+50	1.1	0.2	16	30.5	50	1525
			5+00	0.5	0.4	4	10.0	50	500
			5+40	0.0	0.0	0	2.0	40	80
									9730
		Use 85.7							

(EFM Notice IN38, August 1981)


PROFILES FOR
Parallel Terraces
NAME Tom Sullivan
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Top of Level Ridge - 94.8
Ground Line
Channel Grade
S=0.006
S=0.005
92.0
Terrace #1
Top of Level Ridge - 90.0
Ground Line
Channel Grade
S=0.006
S=0.002
S=0.004
87.8
Terrace #2
95.0
90.0
90.0
85.0
0+00
2+50
5+00
7+50
STATIONS



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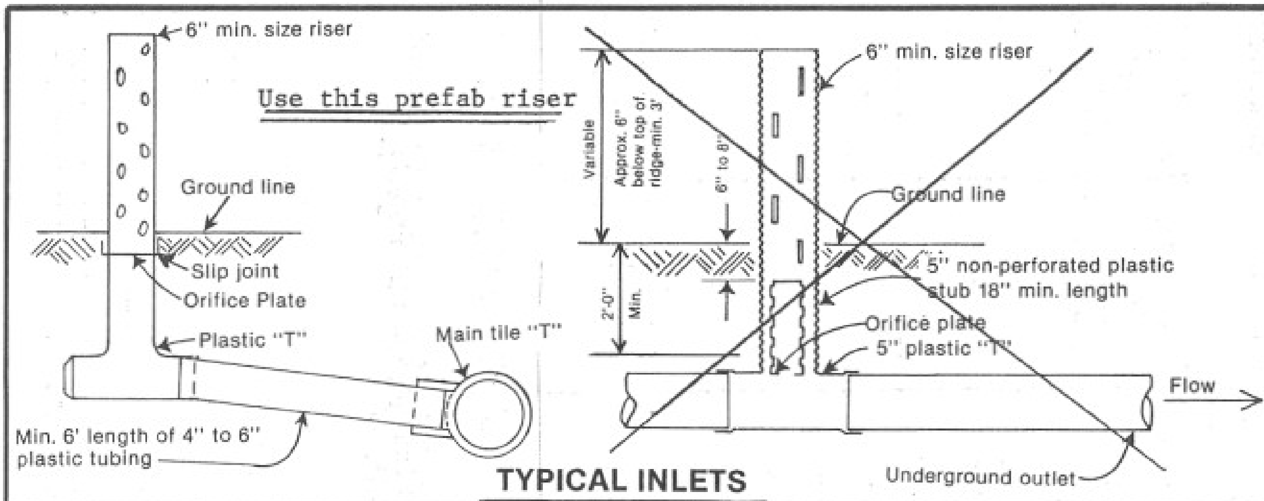
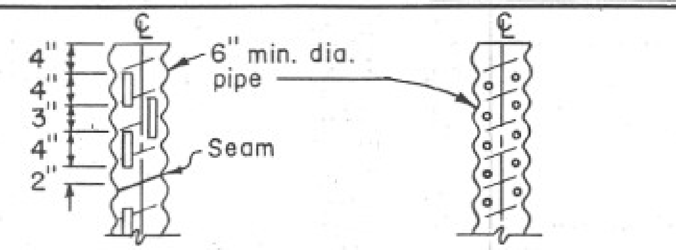
(EFM Notice IN38, August 1981)



TYPICAL INLETS



SLOTTED INTAKE

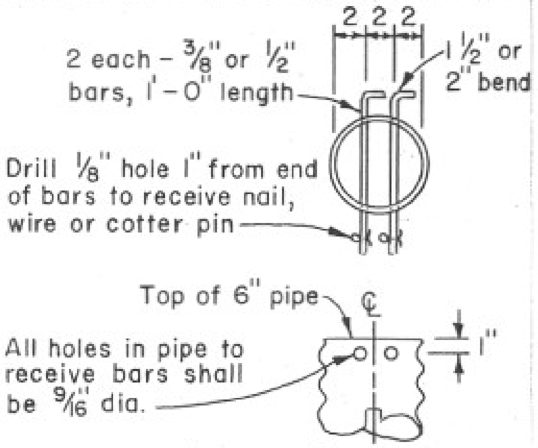
1. CUT 3/4" X 4" SLOTS IN 4 ROWS AROUND THE PIPE (90° SPACING). DO NOT SPACE CLOSER THAN 2" TO THE SEAMS OR END OF PIPE.
2. CAPACITY – 20 ACRE INCHES PER DAY.

ROUND HOLE INTAKE

1. FABRICATE 24 HOLES PER LIN.FT., 3/4" DIAMETER.
2. ALTERNATE FABRICATION APPROXIMATELY 12 HOLES PER FOOT OF 1" DIAMETER.
3. CAPACITY – 8 ACRE INCHES PER DAY.

DETAILS OF RISER

ACTUAL INLET



(If Needed)

DETAILS OF TRASH GUARD

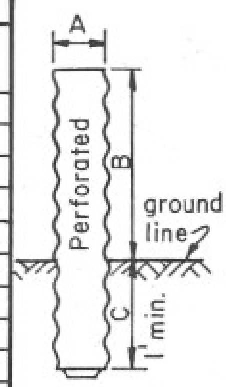
Notes:

1. Aluminum, iron, P.V.C., Smooth P.E. or steel pipe must be used for the riser. A standard trash guard will be installed in the top of the riser unless otherwise specified.

2. The conduit trench from the toe of the backslope to the riser, must be excavated with 1:1 s.s. and backfilled with compacted fill. The backfill around the riser shall be hand tamped.

RISER DIMENSIONS

TERR. NO.	INLET NO.	RISER DIMENS. A	B	C	DIA. ORIF.
1	1	6"	3'	1'	2.0
2	2	6"	3'	1'	2.25
3	3	6"	3'	1'	2.25



INLETS FOR PRACTICE WITH UNDERGROUND OUTLETS AND CONSTRUCTION CHECK DATA

NAME Tom Sullivan

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed .... Date .... Approved by ....
Drawn .... Title ....
Checked .... Title ....
Reviewed .... Sheet No. 4 of 4 Drawing No.

CONSTRUCTION CHECK OF PRACTICE LEAST LIKELY TO MEET SPECIFICATIONS

PRACTICE NUMBER 2 LAND SLOPE 5 % PRACTICE SPACING 105 FEET

STATION	CHANNEL ~~ELEVATION OR~~ ROD READING	RIDGE ~~ELEVATION OR~~ ROD READING	CONSTRUCTED DEPTH *FT.	CUT DEPTH FT.	STORAGE CU.FT./FT.	AVERAGE STORAGE CU.FT./FT.	DISTANCE FT.	CONSTRUCTION STORAGE CU.FT.	DESIGNED STORAGE CU.FT.
0+00	4.6	4.6	0	0	0				
						11.5	100	1150	
1+00	6.2	4.4	1.6	0.6	23				
						24.0	100	2400	
2+00	6.4	4.5	1.8	0.8	25				
						50.5	100	5050	
3+00	7.2	4.3	2.6	0.2	76				
						61.0	100	6100	
4+00	6.8	4.3	2.2	0.2	56				
						42.5	100	4250	
5+00	6.3	4.4	1.7	0.4	29				
						27.0	100	2700	
6+00	6.3	4.5	1.7	0.7	25				
						17.5	100	1750	
7+00	5.6	4.5	1.0	0.9	10				
						5.0	100	500	
8+00	4.6	4.6	0	0	0				
								23,900	17,551

PRACTICE NUMBER	CONSTRUCTED LENGTH FT.
1	750
2	825
3	910
TOTAL	

I CERTIFY THAT THIS JOB MEETS ALL THE REQUIREMENTS OF INDIANA STANDARDS AND SPECIFICATIONS FOR TERRACES (CODE 600) ~~OR WATER AND SEDIMENT CONTROL BASIN (CODE 638)~~ AND THE PLAN AS DESIGNED.

CHECKED BY: D. M. Okay DATE: 8-22-81

REMARKS *Used rod reading of 4.6 as low part of level ridge.

(EFM Notice IN38, August 1981)

IN-ENG-20 2(2) REV. 6-81

SEDIMENT STORAGE CONVERSION

Tons of Soil Loss per Acre per Year	Accumulated Sediment For a 10 Year Period - Inches/Acre									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.0	0.0000	0.0061	0.0122	0.0184	0.0245	0.0306	0.0367	0.0429	0.0490	0.0551
1.0	0.0612	0.0673	0.0735	0.0796	0.0857	0.0918	0.0980	0.1041	0.1102	0.1163
2.0	0.1224	0.1286	0.1347	0.1408	0.1469	0.1530	0.1592	0.1653	0.1714	0.1775
3.0	0.1837	0.1898	0.1959	0.2020	0.2081	0.2143	0.2204	0.2265	0.2326	0.2388
4.0	0.2449	0.2510	0.2571	0.2632	0.2694	0.2755	0.2816	0.2877	0.2939	0.3000
5.0	0.3061	0.3122	0.3183	0.3245	0.3306	0.3367	0.3428	0.3489	0.3551	0.3612
6.0	0.3673	0.3734	0.3796	0.3857	0.3918	0.3979	0.4040	0.4102	0.4163	0.4224
7.0	0.4285	0.4346	0.4408	0.4469	0.4530	0.4591	0.4653	0.4714	0.4775	0.4836
8.0	0.4897	0.4959	0.5020	0.5081	0.5142	0.5204	0.5265	0.5326	0.5387	0.5448
9.0	0.5510	0.5571	0.5632	0.5693	0.5755	0.5816	0.5877	0.5938	0.5999	0.6060
10.0	0.6122	0.6183	0.6244	0.6305	0.6367	0.6428	0.6489	0.6550	0.6612	0.6673

EXAMPLE: 4.5 ton/acre soil loss per year yields 0.2755 inches per acre of sediment over a 10-year period.

Notes
1. All values based on 90 lb/ft^3 soil.
2. See page 8-144 for examples.

ADDITIONAL CONVERSION FACTORS

Wt. of Soil (lbs/ft^3)	80	85	90	95	100	105	110	115	120
Inches/Acre	1.125	1.06	1.0	.95	.90	.86	.82	.78	.75
Cubic Feet/Ton	25.0	23.5	22.2	21.1	20.0	19.0	18.2	17.4	16.7

Exhibit IN-8-14 Accumulated Sediment Storage

(EFM Notice IN-44, 8/84)

Example 1) A terrace is being installed with a computed soil loss of 3.5 ton/acre/year. What additional storage depth in inches must be included in the design storage volume to provide for this sediment accumulation for a 10 year structure design?

From Exhibit IN-8-14 for 3.5 ton/acre/year soil loss, the accumulated 10 year sediment is 0.2143 inches/acre.

Example 2) Find the accumulated sediment for 3.2 T/A/Y of soil loss for 105 lb/ft^3 soil.

From Exhibit IN-8-14 for 3.2 T/A/Y soil loss the accumulated 10 year sediment is 0.1959 inches/acre.

From ADDITIONAL CONVERSION FACTORS for 105 lb/ft^3 soil, the inches/acre conversion factor is 0.86. The 10 year accumulated sediment depth in inches is 0.1959 inches/acre x 0.86 = 0.168 inches in depth per acre.

Example 3) Find the accumulated sediment in depth for 14.8 ton/acre/year for a 10 year period.

$\frac{14.8}{2}$ T/A/Y = 7.4 T/A/Y. From Exhibit IN-8-14 for 7.4 T/A/Y = 0.453 inches of accumulated sediment. For 14.8 T/A/Y the accumulated sediment equals 0.453 x 2 = 0.906 inches/acre.

(Sheet 2 of 2)